Space Weather Technical Forecast

Issued on Tuesday 22 October 2024 at 01:11 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Initial Chance of G1/Minor Geomagnetic Storms. Increasing chance of Radio Blackouts this week.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity observed at GOES16 and 18 was Low - confined to C-class flares with a very smooth X-ray trace that mainly comprised of small magnitude long-period east limb activity from high in the corona.

There are now ten numbered sunspot regions on the visible disc, with AR3864 decaying to plage in the northeast in the period. The main changes observed in the period were areal decay in the trailing spots of AR3859 in the southwest, followed later by some minor intermediate spot growth. AR3863 saw development in its trailers for a time before these began a slight areal decay, while AR3866 emerged and showed a spreading tendency in the southeast.

No Earth directed Coronal Mass Ejections (CMEs) were in evidence in the period.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by ACE at L1, were indicative of a slow regime. The solar wind speed declined from early highs of 375km/s to 325 by the period's end. The solar wind density was within its long-term average of single figures ppcc, while the IMF was at Background levels at or below 6nT, with the north-south component ranging between +6 and -4nT. The phi angle was negative (towards the Sun).

The net result of the above solar wind measures was provisionally Quiet to Unsettled, with a peak Kp of '2+'.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was mainly at Normal Background levels, but with a Moderate peak of 316pfu at 21/1705UTC. The associated 24-hour fluence was well below the Active threshold. The 21/2359UTC observation was 6.24e6 integrated pfu on a slight upward trend.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Activity is Likely to be Low, with a Chance of Moderate activity from isolated M-class flares initially. Activity is then likely to increase through the period, with the return of several notable active regions over the eastern limb: probably becoming Moderate from midweek UTC.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the forecast. A fast wind regime may become established from CH82/+ within the current UTC day, with a Chance of peak Minor geomagnetic storm (G1) conditions, before activity declines to Quiet to Unsettled levels after midweek UTC.

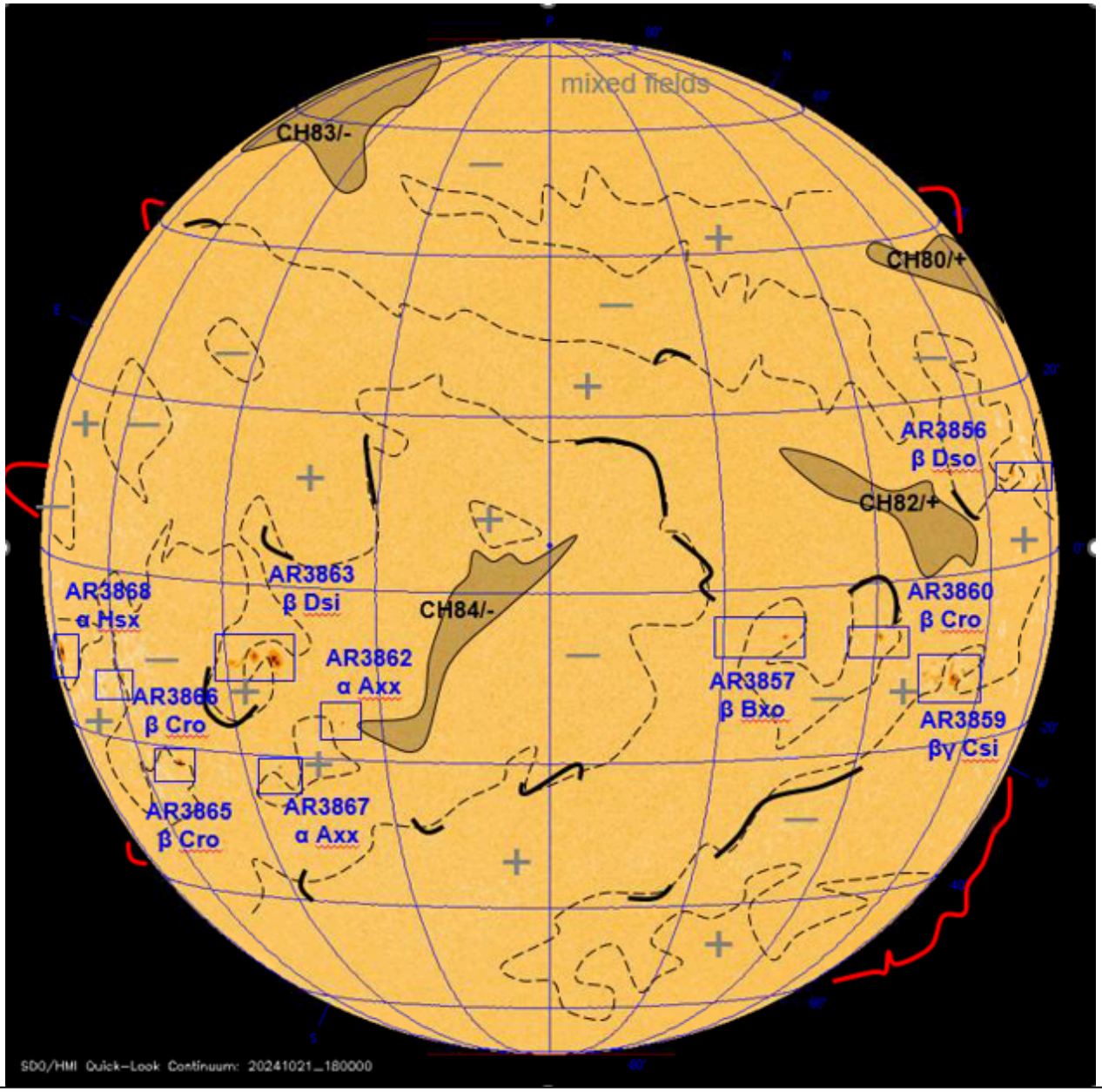
Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is Expected to remain at Background levels.

High energy electron flux at GOES16 is forecast to remain mainly Background to Moderate levels with the associated 24-hour fluence Expected to remain below Active (1e8 total pfu) throughout.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1: Solar synoptic map, valid 21/1800UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms

No Earth-directed CMEs feature in the forecast.

Solar winds are now at Background levels following a minor enhancement from CH80/+ in recent days. The next enhancement is likely to be from the onset of fast winds from CH82/+. This is a recurrent, but smaller feature compared to the previous rotation, but due to its more equatorial location has a high likelihood of connection to Earth. The anticipated arrival for any CIR region is expected within the current UTC day (Tuesday 22 October). A period of Slightly Elevated to Elevated solar winds is then expected to follow. Given that peak G1 Minor Storm intervals were observed on the previous rotation associated with this enhancement, similar is possible on this occasion. MOSWOC Enlil model output does show a weak enhancement possibly associated with this feature, however this is later (in model space) than currently anticipated given the coronal hole's location, and not considered as good guidance.

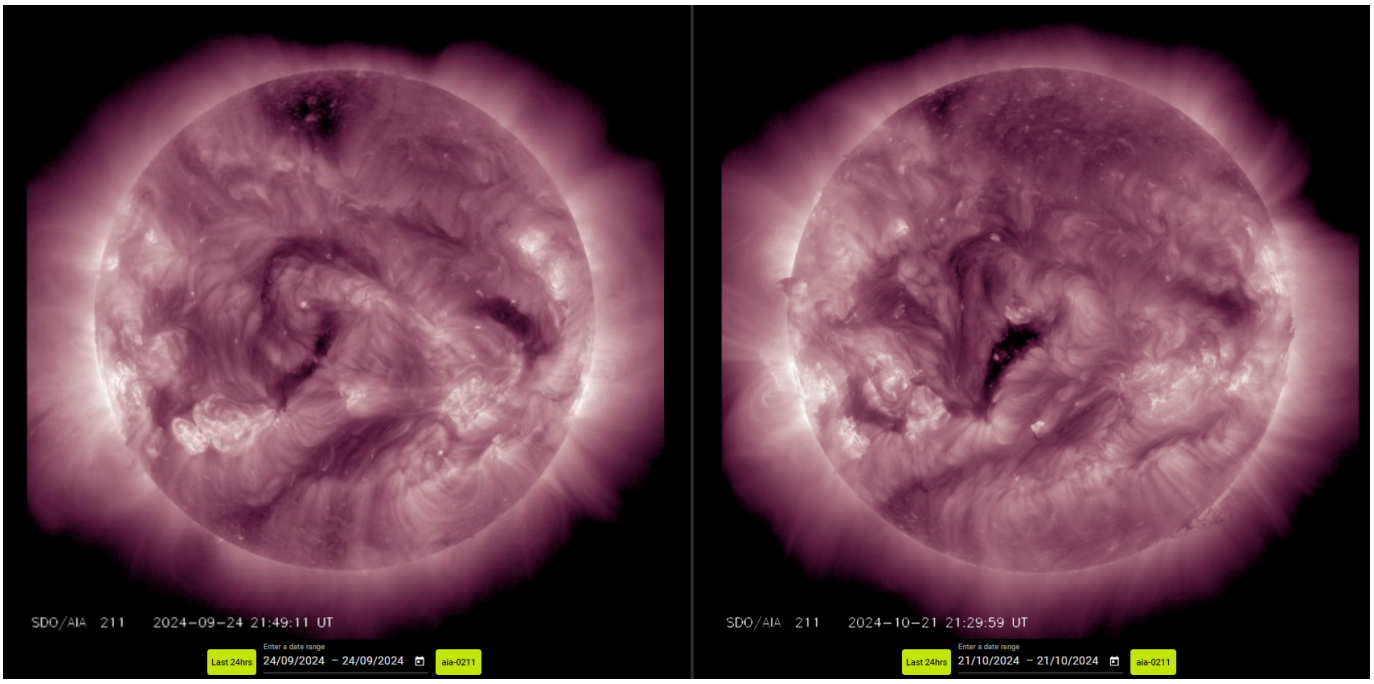
Geomagnetic activity is forecast to be Quiet to Unsettled initially. Fast wind onset from CH82/+ is then expected to bring Active to G1 Minor Storm intervals on Tuesday 22 October. Activity is expected to decline to Quiet to Unsettled levels after midweek UTC.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	50	20	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: Current and past rotation of the Sun in SDO AIA211 imagery, showing a similar longitudinal position for centre-west CH82/+ and it's predecessor, but perhaps with slightly reduced areal extent and intensity.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares

The current disc, while reasonable well-populated in terms of the number of sunspot regions, bears few regions on significance, with very limited C-class activity well-spread and in fact mainly arising from the oncoming eastern limb.

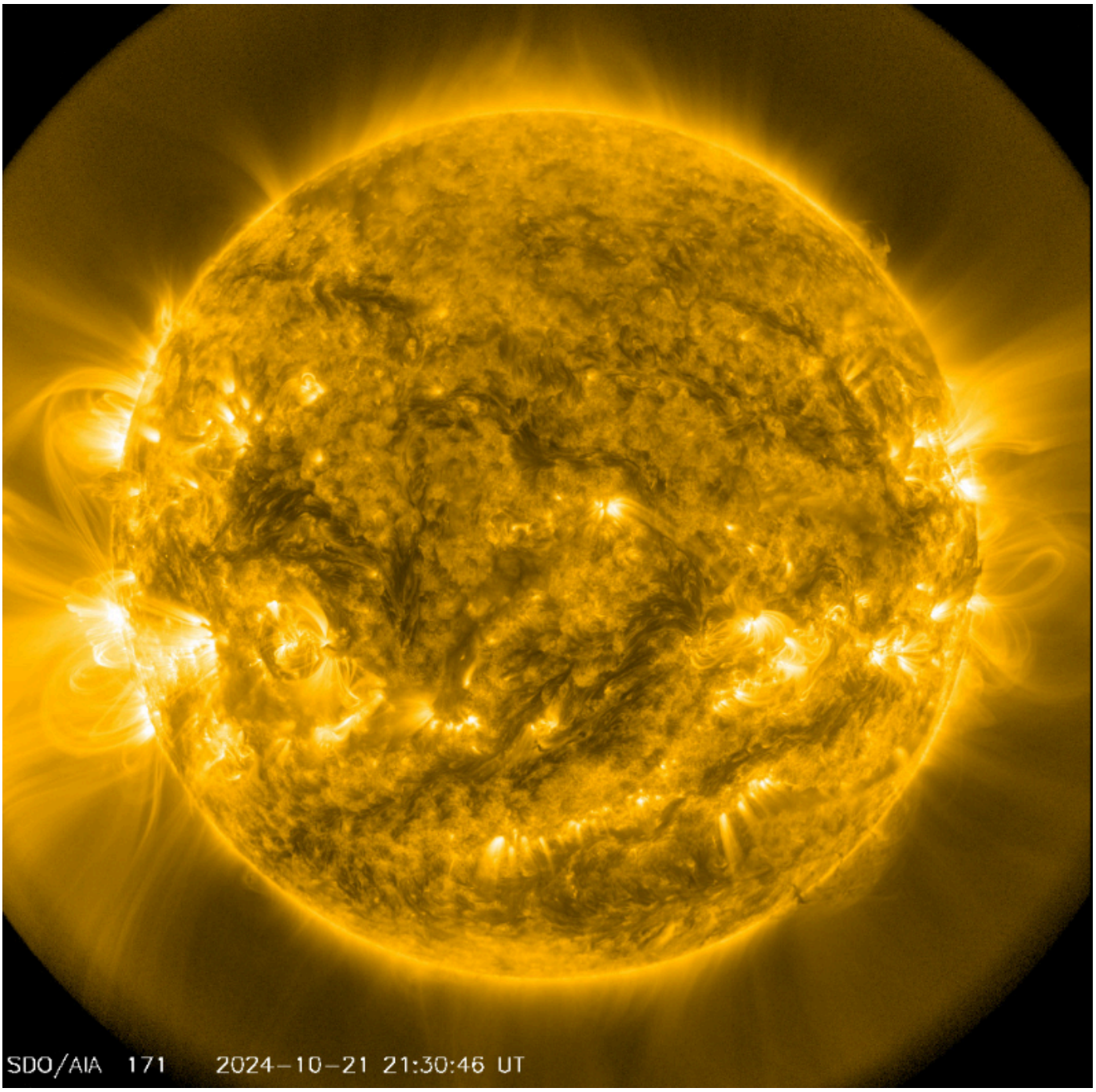
It remains the case that activity is expected to increase in the coming days, as recurrence, recent CME activity, and far-side sounding data all suggest the return of several active regions that were present on the disc earlier in October. Bright looping is evident near the eastern limb in SDO AIA171 imagery, with recurrence suggesting the return of Ex-AR3842, previous source of several strong flares (including SC25's peak X9.0 flare on 03 October) by midweek UTC. As such, activity should increase to become generally Moderate, with M-class flares Likely, and an increased, but still Slight Chance of isolated X-class flares, dependent on the size and configuration of the regions once they become apparent in EUV imagery.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	40	60	60	60
Very Active	R3-R5 (X Class)	No	5	10	10	10

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 3: The southeastern limb dominates in terms of EUV flux brightness in many wavelengths, e.g. AIA171, with hints at a surviving large region here from recent CME evidence, perhaps Ex-AR3842.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is expected to remain at Background levels. There is only a very Slight Chance of a significant enhancement, with limited flare activity observed from the regions currently on the visible disc, and any more potent east limb arrivals a long way from more threatening solar longitudes.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

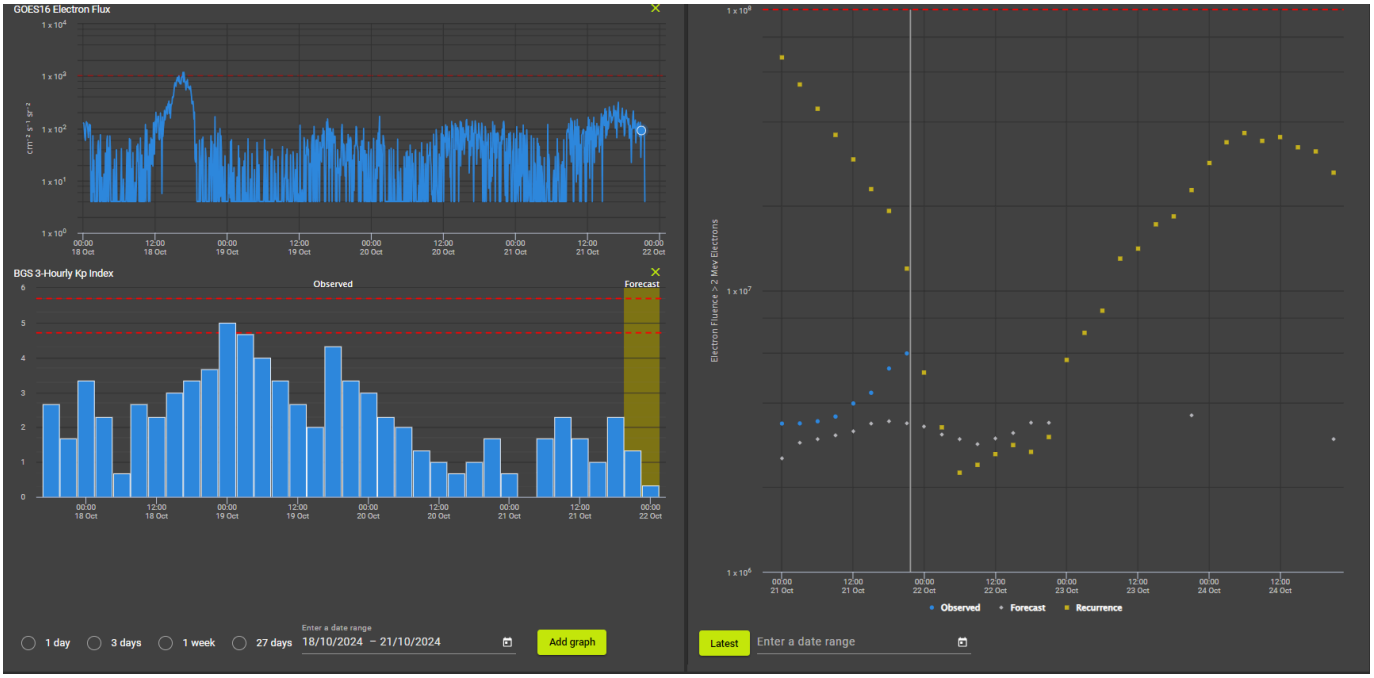
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 has mainly been at Normal Background levels, with only brief incursions above the Moderate threshold at diurnal peak. The expected onset of fast winds from central disc CH82/+ on day 1 (Tuesday 22 October) is expected to suppress flux values at GEO for a time, but with an eventual chance of rising back towards flux peaks of Moderate, or perhaps High levels later in the UTC working week.

The associated 24-hour fluence is currently expected to remain below Active throughout the period, with MOSWOC REFM thought to be providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^8**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ 1×10^9**	No	1	1	1	1

Figure 4: Past 96 hours of GOES16 greater than 2MeV electron flux (top left), seen reacting at GEO to elevated geomagnetic activity from CH80's fast wind into the past UTC weekend. Counts have yet to recover at GEO, and may remain suppresed, with REFM's forecast in white dots on right image considered reasonable guidance.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.